The Analytical Data Warehouse: Empowering Institutional Decision Makers

Giving users the ability to generate their own reports and analyze data revolutionized institutional research at The University of Memphis

By **Gary L. Donhardt** and **Darla M. Keel**

Paper. Pencils. Calculators. Frustration. Once upon a time, the Institutional Research office at The University of Memphis kept up with data the hard way. Then came a move to automation. If someone needed to find out, for instance, out-of-state enrollment data for a particular semester, an analyst would write a customized computer program and produce the numbers for the requestor. Having to write programs for most requests takes time, of course, and the Institutional Research staff occasionally found itself bogged down. Did systems exist that could give users who aren't computer programmers the power to create their own reports and analyses? The department found the answer in SAS IntrNet and ArcView. Let the Institutional Research revolution begin.

Life as We Now Know It

Suppose a dean at The University of Memphis wants to know the grade distribution for courses within a specific term. He or she logs into the Institutional Research Analytical Data Warehouse secured administrative Web site and from a table-generator display selects the desired college and course sections. Within seconds the screen fills with the number of letter grades given for each course, the course's ini-

tial enrollment, the number of withdrawals, the average grade given, and who taught the class. With this Web-based tool the dean can easily make comparisons over terms and among sections.

Meanwhile, an administrator in Alumni Services plans a series of gatherings around the country by first querying an electronic map, zooming in on an area under consideration. To

draw the greatest attendance, the administrator looks for locations in the center of large clusters of alumni residences and chooses an appropriate site.

Across campus a department chair whose program is up for accreditation queries the Program Planning Data Summaries to look at trends in the department over the past several years. Among the items attracting attention

are steady enrollment growth and improved GPAs of majors. The chair notes that test scores are holding steady, as are the number of confirmed degrees. Also, the number of applications is at a healthy level, but the number of students seeking financial aid is up.

Such is life now on The University of Memphis campus. While in the past special computer programs would have to be written, today administrators, faculty, and staff can generate their own reports on the secured and public sites.

Let's Get Technical

How does it work? The ArcView maps are the product of interaction with a map server, and static reports are served from HTML files. For the table generators, SAS resides on a server along with a number of applications, which allow users Internet access to the data sets. The SAS IntrNet Application Dispatcher uses the Common Gateway Interface (CGI) as the pathway from the client's browser to the SAS application. The user has access to a number of powerful interactive applications, yet doesn't have to have SAS installed on his or her machine.

The user enters a request by selecting items on an HTML form. Upon submittal, the Dispatcher channels the request through the CGI to a waiting SAS session. The appropriate SAS application processes the request and returns the result through the CGI to the browser, where it appears on the user's screen.

Secured and Public Sites

With the union of SAS IntrNet and SAS data sets created from census files on students, faculty, and finance, the Institutional Research department began to employ new data reporting and analysis techniques in the context of secured and public sites. Administrators can access the password-protected secured Web site for highly sensitive information, and students, faculty, staff, and the public can access the public site <http://oir.memphis

.edu> for more aggregated data.

A great deal of functionality has been provided for both of these sites. One of the most popular tools is the table generator, which is powerful yet very easy to use. Nothing too complex here, as it takes the appearance of familiar drop-down menus housed within a spreadsheet table.

There are four table generators. The enrollment table generator allows users to customize their own spreadsheets and report headcount, hours attempted, FTE enrollments, cumulative earned hours, grade point averages, high school GPAs, GRE test scores, and retention rates by categories including term, age, majors, and full-time/part-time status. Secured-site users can drill down to individual students. A similar table generator exists for faculty and degree recipients. A budget and planning table generator permits tracking budgets and expenditures by account and object code within colleges and departments.

A few other tools can help the administration on their data hunts. The Instructional Work Load screen lets deans and department chairs access information on instructional workload — who is teaching what and how many credit hours are generated. Another tool shows the results of each ACT test a student has submitted along with answers to inventory questions such as "Would you like special assistance with math skills?" Predictors estimate how the student will do in the 30 most popular freshmen courses and the likelihood of retaining that individual student into the second year. Users can access interactive enrollment projections using the Markov Chain to examine the effects of potential recruitment and retention scenarios. Another tool allows alumni to determine where they graduated within their class and program.

One of the most exciting enhancements has been the development of electronic maps through ArcView. The Geographic Information System (GIS) gives users a spatial view of the data not easily achieved from paper reports. <http://oir.memphis.edu/maps/map_

index.htm>. There are maps on retention, applicants, and student and alumni residential areas. The maps can reveal under-served areas, and, when linked with federal census data, they show population growth and potential markets that the institution may wish to explore.

Data Warehousing

The Institutional Research Analytical Data Warehouse at The University of Memphis is an information repository and retrieval system organized around topics pertinent to decision-making, like "students," "faculty," and "budget." The data are snapshots of the operational files collected on census dates. Because the data reflect the status of the organization at a specific time, and because the repository includes data from multiple terms and multiple years, it supports longitudinal comparisons and institutional decision-making. Because the system has inquiry-only access and is stand-alone, it doesn't compromise the university's operational system.[1]

The Analytical Data Warehouse is made-to-order for most institutional research data concerns. The Web-based tools and GIS maps allow easy access with relatively little training. The information lets administrators manage their operations better by viewing data in modes and combinations that were unavailable before. The warehouse permits the integration of data from a number of sources in support of managerial decision-making. It holds a variety of information, which gives a congruous representation of the organization's status at certain points in time.

Because such systems rely on fixed data, there's no need for update. As new census dates occur, additional data files are captured and added to the repository. Being able to examine trends and compare measures of success places a great deal of analytical power in the hands of users.[2]

Administrators, directors, deans, department chairs, faculty, students, prospective students, and even prospective employees have all used

the service to gain insight into the makeup of the institution.

The Benefits

Allowing users direct access to an analytical data warehouse where they can create customized analyses through the Internet has enormous benefits.

■ By warehousing data and delivering information in a usable fashion, we create value for our clientele. Users can produce customized reports any time, anywhere. Easy-to-use table generation tools give users immediate access with little or no training. Analysts can view data in ways unachievable with the old paper reports. The Web site has become an important source of information for the university.

■ Easy access and quick information delivery support administrative decisions at all levels and improve the way the university does business. Providing the clientele with access through the data warehouse supports decision-making throughout the organization.

■ Giving users the ability to generate their own reports has greatly reduced the effort once spent by the Office of Institutional Research developing ad hoc programs and answering questions.

■ Various applications handle different informational needs and user abilities. Clients can passively view static reports or interact with dynamic analyses that help them develop their own customized reports.

■ The hardware and software are relatively inexpensive and easy to use. Whereas some data warehouses take years to design and implement, many of the applications using SAS IntrNet can be up in a matter of days. The developmental and maintenance costs are minimal.

■ Publication costs for the office have disappeared.

The Analytical Data Warehouse has opened data to new audiences and proven itself invaluable to a wide variety of users. Users can generate their own reports and create their own customized analyses. GIS maps provide wider perspectives and aid in spatial examinations. The warehouse empowers institutional decision makers by placing inquiry and analysis tools at their fingertips. So, are you ready for a revolution in your department? *e*

Endnotes

1. W. H. Inmon, "What is a Data Warehouse?" *Prism*, 1 (1), <http://www.cait.wustl.edu/cait/papers/prism/vol1_no1/>.

2. W. H. Inmon, *Building the Data Warehouse* (New York: John Wiley & Sons, 1996), p. vii–ix.

Gary L. Donhardt (donhardt@memphis.edu) is the Director of Institutional Research and Darla M. Keel (darkeel@memphis.edu) is the Web Content Specialist for Institutional Research at The University of Memphis in Memphis, Tennessee.